ELECTRONIC INSTRUMENTS

DATA SHEETS

BY

MP MASTER
MA23731

NAGARD LTD

Amplifier Type 2103)
Time Base Type 3017) Model DE103

Instrument
Serial No: 358

NAGARD LTD

OPERATING INSTRUCTIONS

for

WIDE BAND CALIBRATED OSCILLOSCOPE MODEL DE103

GENERAL INSTRUCTIONS

This oscilloscope consists of a Power Unit type 4010, a circuit diagram of which appears on sheet reference No. E/15006, together with a Time Base type 3017 (circuit sheet No. ref. E/15010) and two channel DC Amplifier type 2103 (circuit sheet ref. No. E/15012).

The instrument is designed to have the simplest possible controls, and a study of the following notes will ensure that the best results are quickly obtained.

TIME BASE TYPE 3017

The Type 3017 Time Base is a modified Miller-Transitron Time Base, made under British Patent No. 679,294, and specially adapted for accurate calibration of sweep velocity. It provides facilities for the rapid determination of the time interval between specific points of any signal.

The calibration of the Time Base is independent of valve changes, and it is important to note that it is the velocity (not the repetition rate) of the sweep which is set by the controls.

Method of Time Measurement is as follows:-

The sweep velocity can be continuously varied by the main control dial, which is 3 inches in diameter and marked by divisions calibrated in microseconds over a range of 1 to 3.6. In conjunction with the ten position range switch the time readings are extended by multiplying factors of 1, 3, 10, 30, 100, 300, 1000, 3000, 10,000 and 30,000. The product of the reading of the main time dial and that of the range switch gives the time interval on the trace between the anti-parallax rulings spaced 2 inches apart, i.e. corresponding to 20 graticule divisions. Over any other part of the trace the time interval can be measured in terms of the graticule divisions.

TIME BASE TYPE 3017 (continued)

The Time Calibration Accuracy is within 2% except in the 1 and 3 positions of the range switch; in these two positions it is approximately 10% and 5% respectively. For this the focus and astigmatism controls must be correctly set to give the finest trace.

The Frequency of a repetitive signal may be measured by taking the reciprocal of the time interval between consecutive signals.

SYNCHRONISATION AND TRIGGERING. When the SWEEP GENERATOR STABILITY control is turned fully anti-clockwise, the time base is in stable equilibrium, and can only be made to run by the application of a triggering signal.

As the SWEEP GENERATOR STABILITY control is rotated clockwise, the amplitude of signal required to trigger the time base decreases, until eventually the time base becomes free-running without application of any triggering signal.

To obtain optimum performance in triggered operation the TRIGGER SIGNAL AMPLITUDE control should first be turned fully anti-clockwise and the SWEEP GENERATOR STABILITY control fully clockwise. The latter control should then be turned anti-clockwise just far enough to stop the time base from running, when the TRIGGER SIGNAL AMPLITUDE control should be turned clockwise until the time base is triggered. For "continuous" operation it is merely necessary to rotate the SWEEP GENERATOR STABILITY control sufficiently far clockwise to render the time base free-running and to turn the TRIGGER SIGNAL AMPLITUDE control sufficiently far clockwise to provide adequate synchronisation. Turning the TRIGGER SIGNAL AMPLITUDE control too far clockwise or the SWEEP GENERATOR STABILITY control too far anti-clockwise may cause a shortening of the sweep.

Satisfactory triggering via the TRIGGER AND AMPLIFIER INPUT terminal can be obtained from signals of 20 millivolts upwards.

The Sync. switch on the time base panel has two positions, enabling choice to be made of either positive or negative synchronisation or triggering.

Two switches will be found on the top panel of the oscilloscope each having two positions marked "IN" and "OUT". These switches control D.C. restoring diodes at the grids of the C.R.T. When these switches are "IN" the traces are maintained at constant brightness at all speeds.

TIME BASE TYPE 3017 (continued)

They can be left in this position for triggered operation, but a bright spot will then appear at the beginning of each scan, which is disturbing at low repetition rates or in single stroke work. However, by switching to the "OUT" position, the scan is increased in intensity relative to the bright spot, so that, by turning the brightness control down, this spot can be eliminated.

In general, the first 5% of the scan should not be used for measurement.

X SHIFT

Two X shift controls are provided on the instrument. These permit individual adjustment of X shift on each beam, enabling the traces to be aligned in any desired manner.

X AMPLIFIER

An X amplifier is provided for use in applications where the time base is not required. It has a gain of over 100 and the response is D.C. to 500 Kc/s (less than 6 dB down). An attenuator giving reduction factors of 1, 10 and 100 is provided. This is controlled by the sync. switch of the time base.

When the X amplifier is in use the time base range switch must be switched to "OFF" and the "Trigger Signal Amplitude" control turned anti-clockwise.

TWO CHANNEL AMPLIFIER TYPE 2103

This consists of two identical and independent amplifiers, providing a push-pull output for each pair of Y plates in the double-gun C.R. Tube.

Input Circuits The input sockets are fed to corrected attenuators giving attenuation ratios of 1, 3, 10, 30, 100 and 300. The input impedance consists of 20uuF shunted by 1 Megohm, except on the X3 attenuation setting where the resistance is 1.5 Megohms.

Sensitivity The gain of each amplifier is approx: 100, giving a maximum sensitivity of 1 inch per 600mV pk-pk. Using the attenuator the minimum sensitivity is 1 inch per 180v. pk-pk.

The maximum output free of distortion is 2 inches on each channel.

TWO CHANNEL AMPLIFIER TYPE 2103 (continued)

In this connection it should be noted that the undeflected positions of the two traces are not in the centre of a double-gun tube, but about $\frac{3}{4}$ inch above and below the centre for channels A and B respectively. Consequently for maximum deflection without distortion the traces should be adjusted so that their mean positions are approximately at these points. Trace A should be above trace B. It is undesirable to cross them over for the above reason.

Bandwidth. The rise-time of each amplifier is such as to present a perfect pulse as having a rise-time of 0.035 microsecond.

The response to sine-wave signals is reduced by not more than 1dB and 3dB at 6 Mc/s and 10 Mc/s respectively. The 6dB and 12dB points occur at 15 Mc/s and 20 Mc/s approx.

The above figures are independent of attenuator settings.

Voltage calibration. An internal calibrated D.C. voltage is provided for each amplifier, controlled by dials on the front panel. The range is from 0 - 1 volt, extended by use of the attenuators to 300 volts.

The accuracy of calibration is ± 5% for signals from 300 volts down to 200mV. For smaller signals the accuracy is ± 10mV.

To measure voltage the Cal Voltage dial is first set to zero. The Balance control is then adjusted to bring the top of the signal, or portion of the signal which is to be measured, under a convenient horizontal line on the graticule. The Cal Voltage dial is then adjusted to bring the bottom of the signal, or portion thereof, to the same horizontal line as before. The reading on the Cal Voltage dial, multiplied by the attenuator setting, gives the amplitude in peak - peak millivolts.

Direct connections to CRT electrodes.

To make direct connections to the Y plates the amplifier side cover of the oscilloscope must first be removed. The plugs are then transferred from the outer to the inner sockets, on the paxolin panel at the top of the amplifier chassis. These sockets are marked "INT" and "EXT" respectively. Connection can now be made to the Y terminals on the top panel of the oscilloscope. It is not necessary to change over the plugs on both channels if direct connection is only required on one gun of the C.R.T.

TWO CHANNEL AMPLIFIER TYPE 2103 (continued)

If connections are made to the Y plates via condensers the amplifier shift controls will remain operative and the correct mean potentials will be automatically maintained. If D.C. connections are made to the Y plates then the mean potential applied must be approx. + 230 volts in order to maintain good focus.

To make direct connections to the X plates the Time Base side cover must be removed.

The plugs must now be removed from the sockets at the rear of the Time Base chassis and inserted in the appropriate sockets on the metal panel above. The sockets are marked to indicate their purpose. Connections may now be made to the X terminals on the top panel of the oscilloscope. It is not essential to transfer both plugs if only one gun requires external connection.

The same remarks apply regarding shifts, type of coupling and mean potential as given above for the Y plates.

C.R.T. grid connections

The C.R.T. grids are normally connected via high-voltage couplings to the time base, so as to provide beam-brightening during the scan. If this is not desired, or external beam modulation is to be applied, the plugs on the paxolin strip over the Time Base chassis can be transferred from the sockets marked INT to those marked EXT. This disconnects the internal brightening pulse and permits application of modulating signals to the grid terminals on the top panel of the oscilloscope.

INPUT

ATTENUATOR

R1 1M ½W 2%
R2 125K V8 HS 2%
R3 36K ⅛ H.S 2%
R4 10K ⅛W HS 2%
R5 3.3K ⅛ HS 2%
R6 1M ½W HS 2%
R7 1M ½ HS 2%
R8 3900 3w
R9 68 ½w 10%
R10 68 ½w 10%
R11 1500 H.S ¼
R12 1500 H.S ¼
R13 68K HS ¼
R14 68K HS ¼
R15 68 ½w 10%
R16 68 ½w 10%
R17 4700 ¼w 10%
R18 1K ¼w H.S
R19 68 ½w 10%
R20 68 ½w 10%
R21 1K ¼w H.S
R22 4700 ¼w 10%
R23 10K 1w
R24 10K 1w
R25 68 ½w 10%
R26 1K 7w
R27 68 ½w 10%
R28 68 ½w 10%
R29 68 ½w 10%
R30 1500 6w w/w N1
R31 1M ½w
R32 1M ½w
R33 1500 6w w/w N1
R34 1500 8w
R35 1000 4w
R36 25 or 33 ½w 10%
R37 25 or 33 ½w 10%
R38 2500 12w
R39 68 ½w 10%
R40 68 ½w 10%

C1 59p
C2 282pF
C3 1100pF
C4 2950 PF
C5 0·1
C6 400P

CV1 3-30pF
CV2 3-30pF
CV3 3-30pF
CV4 3-30pF

RV1 5K 3w VSHIFT
RV2 5K 3w
RV3 5K 3w BALANCE
RV4 500 3w
RV5 500 3w

L1 10-20μH
L2 10-20μH
L3 17-34μH
L4 17-34μH

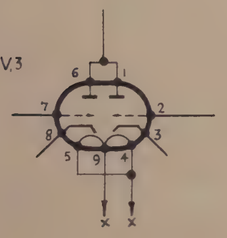
V1 V2 V3 V4 V6 V7

+150 +90 +81v +1v +82½v +84½v +220V
HT+1 HT+2
-90 -90v
+150v +90v
-300v

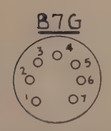
EXT Y1 EXT Y2
Y1 Y2

HT+2 +265v 7 H 140 mA
HT+1 +275v 1 P 120 mA
4 J
6 K 70 mA
3 G & L
8 M & N
6·3v 6A AC

V3



B7G



V6, V7 90C1 MULLARD

B9A

V3 ECC81 MULLARD
V1 V2 EF80 MULLARD
V4, V5 EL83 MULLARD

AMPLIFIER TYPE 2103

ONE CHANNEL ONLY SHOWN

NAGARD LTD BELMONT SURREY ENGLAND

ISSUE	MOD	DATE	DRAWN		21-12-54
1	—	21-12-54	TRACED		
			CHECKED		
			APPROVED	M.J.G	7-4-55

DIAGRAM. N° E/15,012

NAGARD LIMITED

18 Avenue Road, Belmont, Surrey

Test Certificate & Guarantee

Instrument Serial No. 358 Type DE.103

Certified that this instrument has been inspected and tested, and that it conforms to the appropriate standards as regards construction and performance.

For & on behalf of Nagard Ltd.

H. Trudge

Chief Inspector.

Date 9th May 1955

Guarantee

To the original purchaser this instrument is guaranteed for a period of twelve calendar months from the invoice date.

During this period our liability is limited to making good any defects which may develop in normal use, and which arise from faulty design, materials or workmanship, provided that its original construction as supplied has not been interfered with by the user.

Valves and cathode ray tubes are subject to their respective makers' guarantees.

Should an instrument be found defective, the precise complaint should be formulated in writing, and upon our agreement being given to the return of the instrument it should be forwarded, carefully packed, and carriage paid to our works.

Outside the United Kingdom of Great Britain the appointed agent of the Company should be firstly advised of any complaints.

NAGARD LTD.

18 Avenue Road, Belmont, Surrey.

MP MASTER
MA23731